Axler, Chapter 5: 8, 10, 11, 14, 18, 19 (as usual, your answer must be proved in both 18 and 19),

1. Let $V$ be a finite dimensional vector spaces, and let $v_1, \ldots, v_n \in V$ be a basis. Let $V^* = \mathcal{L}(V, F)$ as in the previous homework.

   (i) Prove that there are unique elements $S_1, \ldots, S_n \in V^*$ such that

   \[ v = (S_1(v))v_1 + \cdots + (S_n(v))v_n \]

   for all $v \in V$

   (ii) Prove that $S_1, \ldots, S_n \in V^*$ is a basis.